

EUROPEAN ORGANISATION  
FOR THE SAFETY OF AIR NAVIGATION



**EUROCONTROL EXPERIMENTAL CENTRE**

**MODE-S SPECIFIC SERVICES  
AND DATA LINK TEST BENCH**

**EEC Note No. 11/98**

EEC Task C07  
EATCHIP Task SUR-3-E1

Issued: April 1998

**REPORT DOCUMENTATION PAGE**

<b>Reference:</b> EEC Note No. <b>11/98</b>		<b>Security Classification:</b> Unclassified				
<b>Originator:</b> EEC - COM ( CoE <b>Communications</b> )		<b>Originator (Corporate Author) Name/Location:</b> EUROCONTROL Experimental Centre B.P.15 F - 91222 Brétigny-sur-Orge CEDEX FRANCE Telephone : +33 (0)1 69 88 75 00				
<b>Sponsor:</b> EATCHIP Development Directorate DED.3		<b>Sponsor (Contract Authority) Name/Location:</b> EUROCONTROL Agency Rue de la Fusée, 96 B -1130 BRUXELLES Telephone : +32 2 729 9011				
<b>TITLE:</b>  <b>MODE-S SPECIFIC SERVICES AND DATA LINK TEST BENCH</b>						
<b>Author</b> P.Hunt / P.Brun	<b>Date</b> 04/98	<b>Pages</b> v + 19	<b>Figures</b> 9	<b>Tables</b> -	<b>Appendix</b> 1	<b>References</b> 5
<b>EATCHIP Task Specification</b> SUR-3-E1	<b>EEC Task No.</b> C07		<b>Task No. Sponsor</b> SUR-3-E1		<b>Period</b> 4/97 to 1/98	
<b>Distribution Statement:</b> (a) Controlled by: Head of COM (b) Special Limitations: None (c) Copy to NTIS: YES / NO						
<b>Descriptors (keywords):</b>  "Mode-S Specific Services" IIMSES DAP "Data Link" ModeS						
<b>Abstract:</b>  This note describes a Mode-S test bench and test facility developed at the EUROCONTROL Experimental Centre. An aircraft fitted with MODE-S specific services and data link equipment may be fully tested using this mobile ground station. Downlink Aircraft Parameters (DAPs) may be validated, uplink and downlink messages sent and controlled and all types of Broadcast messages may also be extracted and verified. The hardware and software used is described within this note.						

This document has been collated by mechanical means. Should there be missing pages, please report to:

EUROCONTROL Experimental Centre  
Publications Office  
B.P. 15  
91222 - BRETIGNY-SUR-ORGE CEDEX  
France

**MODE-S SPECIFIC SERVICES  
AND  
DATA LINK TEST BENCH**

**by**

**Patrick HUNT  
Philippe BRUN**

**Summary**

This note describes a Mode-S test bench and test facility developed at the EUROCONTROL Experimental Centre. An aircraft fitted with MODE-S specific services and data link equipment may be fully tested using this mobile ground station. Downlink Aircraft Parameters (DAPs) may be validated, uplink and downlink messages sent and controlled and all types of Broadcast messages may also be extracted and verified. The hardware and software used is described within this note.

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## 1. INTRODUCTION

More and more aircraft will be fitted with Mode S data link equipment in the coming years.

In the context of the Eurocontrol IIMSES programme, Eurocontrol is paying for the equipping of several aircraft with Mode S Specific Services capabilities. This will enable the enhanced surveillance capability of the POEMS radars to be validated during the pre-operational phase, and at a later stage enable ATN type messages to be exchanged.

As no Test Bench is available on the market at the present time, a small portable Test Bench has been developed at the EEC in order to test the Mode S installation of these aircraft. The installations conform as far as is possible to the "Mode S Specific Services Manual" issued by SICASP (June 97) and eventually to be included in the ICAO Annex 10.

This technical note describes the Test Bench hardware and application software.

This test bench has already been used to verify a Mode S Specific Services installation on the Airbus Inter Transport A300/600ST aircraft (a.k.a. Beluga) at Toulouse airport.

## **2. HARDWARE**

A low powered Ground Station developed by Dassault Electronique is used to generate and receive Mode S interrogations and replies.

A PC driven Input/Output card also developed by Dassault enables a standard PC to communicate with and control the Mode S Ground Station.

An omni-directional or simple directionally fixed antenna is used at the RF output of the Test Bench.

The Test Bench has a range of about 70 Km with this type of antenna.



### 3. SOFTWARE

The application software package for the Test Bench has been developed by EEC.

The application is written in C and runs under the control of a real time multi-tasking system already used by us before for several other real time applications on Pcs.

The real time operating system is from On-Time GmbH. Germany and is called RT Kernel.

A library of functions was provided by Dassault [2] to enable control of their PC card. These functions have been updated and extended by Eurocontrol.

#### 3.1. Functions performed by Test Bench Software

##### 3.1.1. *Listen for Mode S acquisition squitters*

Extract Mode S address  
Extract transponder capability

##### 3.1.2. *Listen for Mode S extended squitters*

Receive Position squitters  
    Airborne position reports  
    Ground position reports  
Receive Air Vector Squitters  
Receive Identification squitters

##### 3.1.3. *Send all call requests and decode replies UF11/DF11*

##### 3.1.4. *Send surveillance request and receive replies UF 4/5 DF 4/5*

##### 3.1.5. *Send Comm A message/requests and receive Comm B replies UF 20/21 DF 20/21*

##### 3.1.6. *Send Comm C messages up to 16 segments UF 24*

##### 3.1.7. *Receive Comm D messages up to 16 segments DF 24*

##### 3.1.8. *Extract all GICB messages - BDS 05 to BDS FF*

Display where relevant the aircraft parameters in engineering units

**3.1.9. *Extract transponder Capability Report - BDS 10***

**3.1.10. *Extract Aircraft Identification Report - BDS 20***

**3.1.11. *Extract TCAS Report - BDS 30***

**3.1.12. *Listen for and extract any Broadcast Messages emanating from Aircraft***

Change of Capability Report  
Change of Aircraft Identity Report  
Air Initiated Comm B message available  
Comm D message available

## 4. OPERATIONAL DETAILS

The software package produced by Eurocontrol is an executable programme which runs as a stand alone application on a standard IBM compatible PC.

This executable programme can be distributed freely, if further development is envisaged by a user it would be necessary to purchase a licence from On Time GmbH. for the RT Kernel system [4].

### 4.1. Application Details

The main menu of the application allows you to perform the following functions. During the tests all data sent and received by the bench is recorded on the hard disk.

#### 4.1.1. *UF 11/DF 11*

This function transmits All Call interrogations (UF 11) and listens for the aircraft replies (DF 11). When the Mode S address is acquired, the aircraft is then interrogated at a low rate with DF 4, 5, 20 and 21 interrogations (Rate is about 1/2 Hz). The Mode A code and barometric altitude provided by the Mode S replies are then displayed on the PC screen.

#### 4.1.2. *GICB*

All GICB registers can be extracted and displayed on the PC screen. There is a secondary menu which enables the operator to choose one or more GICB registers or a group of GICB registers to be extracted consecutively by the bench. The contents of certain GICB registers are displayed in engineering units when they have been specified by the Mode S Specific Services Manual [1] or by previous Eurocontrol documents [5]. As well as the aircraft data GICBs the GICBs 10, 20, 30 are displayed (Capability report, Flight Identity and TCAS status).

#### 4.1.3. *CommA*

CommA data link messages are sent to the aircraft. A second menu lets you choose from an uplink message list or send a free text message. At the present time the message list contains messages formatted for the "old" data link protocol used by Eurocontrol. Mode S Specific Service messages (or ATN message types) could be added at a later stage. These messages are sent to the ADLP by the transponder and have to be validated on the aircraft side.

#### 4.1.4. *CommB*

This function listens during the surveillance phase to detect if the DR (Data Request) field of the Mode S reply has changed, indicating a downlink message has been announced by the aircraft and is waiting to be extracted by the ground. The DR field

may be 0, 1, 2, 4, or 5 depending on the type of message being downlinked. DR=0 means no message waiting, DR=1 means an AICB message is waiting, DR=2 means a TCAS state message is waiting, and DR 4 or 5 means a Broadcast message is waiting. The messages are extracted and displayed on the PC screen, decoding is done when possible. CommB closeout messages are sent after successful extraction of the AICBs. Broadcast messages time themselves out after 18 seconds. DR > 16 and < 32 are possible but indicate CommD messages waiting and are dealt with later on.

#### **4.1.5. Address Mode S**

This function is simply to choose a Mode S address from the address list if several aircraft are within range and it is required to test only one particular aircraft.

#### **4.1.6. CommC**

CommC (U-ELMs) are sent uplink to the aircraft. Up to 16 segments may be sent, the message sent and the acknowledgement from the aircraft are displayed on the screen. If retries are required for some segments the number of retries and the segments resent are indicated.

#### **4.1.7. CommD**

CommD (D-ELMs) are extracted from the aircraft transponder and displayed on the PC screen. Up to 16 downlink segments may be received in one burst.

The DR field is checked during surveillance replies, a DR field between 16 and 31 indicates a CommD message is waiting to be extracted and the DR value indicates the number of segments to be extracted (Number of segments announced = DR - 15). A close out is sent by the bench after each CommD successfully extracted.

#### **4.1.8. Squitter**

This function simply listens to aircraft squitters and displays them on the PC screen. The Mode S addresses are decoded showing which country the aircraft is from according to the ICAO Annex 10 list, and if possible the aircraft registration (France, USA) otherwise the Mode S address is shown in hexadecimal code (6 digits - 24 bits).

#### **4.1.9. Stop Display**

This function simply toggles the screen updating, it is sometimes useful to hold the screen display steady whilst checking some parameters or values. The bench continues to function normally during this time and the screen can be restarted by selecting stop display a second time (toggle).

#### **4.1.10. ADS-B**

The bench listens for acquisition and extended squitters from aircraft. The number of both types of squitter is counted, in order to verify the squitter rates. Extended squitter position reports are decoded from the CPR data and the aircraft's position is shown in latitude and longitude, the altitude is also decoded. The identification squitter is also decoded and the aircraft's flight identification is displayed.

Implementation of all the new extended squitter types will be added at a later stage when they have been finalised.

## 5. COSTS

In order to give the reader an idea of the costs involved to develop his own test tools here are the prices of the main components required.

## 6. CONCLUSION

This test bench has already proved to be a very useful tool when validating Mode S data link installations. We intend to develop other Mode S tools using the test bench.

## GLOSSARY

CPR	Compact Position Report [1]
GICB	Ground Initiated CommB message
AICB	Air Initiated CommB message
BDS	CommB Definition Subfield
CommA	Short data link uplink message (56 bits)
CommB	Short data link downlink message (56 bits)
CommC	Long data link uplink message (112 bits)
CommD	Long data link downlink message (112 bits)
IIMSES	Initial Implementation of Mode S in Europe
POEMS	PreOperational European Mode S Stations
ELM	Extended Length Message
U-ELM	Uplink ELM (a.k.a. Comm C)
D-ELM	Downlink ELM (a.k.a. Comm D)

## REFERENCES

- [1] - Mode S Specific Services Manual - ICAO Doc 9688-AN/952 June 97
- [2] - Mode S Data-Link Ground Station - IRIS Software user's Manual -  
Dassault Electronique 1408-903-000 Issue 3
- [3] - Mode S Data-Link Ground Station - Supply Description Manual  
Dassault Electronique 1408-902-000 Issue 3
- [4] - RTKernel C 4.5 - User's manual - On Time Gmbh Hamburg
- [5] - DLPU Model C2 Aircraft Installation & BDS Allocation  
EEC Note 25/95 by P.Hunt





Figure 1 - Initial Menu

Downlink Squitter						ModeS
DF11	107.0848513	0850mU	Alt=0	dT=0.310209	A=801C01	IND 801C01
DF17	107.3606077	0930mU	Alt=0	dT=0.275756	A=801C01	FRA F-BAM
DF17	107.7569790	0900mU	Alt=0	dT=0.396371	A=801C01	CIU 038004
DF11	107.9300286	1050mU	Alt=0	dT=0.173051	A=801C01	CHE 4B25C3
DF17	108.1443098	1020mU	Alt=0	dT=0.214281	A=801C01	CAN C00000
DF17	108.2434837	1160mU	Alt=0	dT=0.099174	A=801C01	ZAF 00C001
DF17	108.5825714	1020mU	Alt=0	dT=0.339088	A=801C01	ZAF 00C001
DF11	109.1109067	0850mU	Alt=0	dT=0.528335	A=801C01	ZAF 00C000
DF17	109.2263909	0730mU	Alt=0	dT=0.115484	A=801C01	JPN 85C090
DF17	116.0459735	0660mU	Alt=0	dT=6.819583	A=801C01	RUS 1D9030
DF11	116.1537070	0860mU	Alt=0	dT=0.107733	A=801C01	RUS 122347
DF17	116.4754267	0830mU	Alt=0	dT=0.321720	A=801C01	
DF17	116.8715668	0810mU	Alt=0	dT=0.396140	A=801C01	
DF11	117.2020150	0860mU	Alt=0	dT=0.330448	A=801C01	
DF17	117.2353510	1000mU	Alt=0	dT=0.033336	A=801C01	
DF17	117.7971692	0880mU	Alt=0	dT=0.561818	A=801C01	
DF17	118.2255415	0830mU	Alt=0	dT=0.428372	A=801C01	
DF17	118.3498061	0870mU	Alt=0	dT=0.124265	A=801C01	
DF11	118.3996521	0780mU	Alt=0	dT=0.049846	A=801C01	

  

Control		Last
The following commands are available:		(1) \$85c090
1 == UF11/DF11	2 == GICB	(2) \$1d9034
3 == Comm A	4 == Comm B	(3) \$122347
5 == Address Mode S	6 == Comm C	(4) \$038004
7 == Comm D	8 == Squitter	(5) \$801c01
9 == Stop Display	10 == ADSB	(6) \$38019b
		(7) \$926347
		(8) \$00c000

  

PCB Status	
.....	
Current	\$801c01

Please enter 0 to exit or 1-10 :

Figure 2 - Squitter reception

```

Downlink DF
DF=11 AA=801c01 CA=3 PI=0
DF=11 AA=801c01 CA=3 PI=0
DF=04 Altitude = $2710 / 10000 Ft AP=801c01
DF=11 AA=801c01 CA=3 PI=0
DF=20 Altitude = $2710 / 10000 Ft AP=801c01
DF=11 AA=801c01 CA=3 PI=0
DF=11 AA=801c01 CA=3 PI=0
DF=11 AA=801c01 CA=3 PI=0
DF=11 AA=801c01 CA=3 PI=0
DF=11 AA=801c01 CA=3 PI=0
DF=20 Altitude = $2710 / 10000 Ft AP=801c01
DF=11 AA=801c01 CA=3 PI=0
DF=05 Code = 7500 AP=801c01
DF=11 AA=801c01 CA=3 PI=0

Control
The following commands are available:
1 11 UF11/DF11
2 11 Comm A
3 11 Address Mode S
4 11 Comm B
5 11 Comm C
6 11 Squitter
7 11 Comm D
8 11 Stop Display
9 11
10 11 ADSB

Please enter 0 to exit or 1-10 :

PCB Status
.....
Current @
$801c01

Last @
(1) $801c01
(2) $0000000
(3) $0000000
(4) $0000000
(5) $0000000
(6) $0000000
(7) $0000000
(8) $0000000

```

Figure 3 - Altitude and Mode A Code Reception



```

ADSB-DE
-----
Logiciel de réception des squitters ADS-B/Mode S, version 2.0

Latitude référence : ..... N 48°36.0944'
Longitude référence : ..... E 2°19.3546'
Répertoire de sauvegarde : ..... courant

Temps écoulé : ..... 0h 00mn 05s

Nombre de messages ADS-B reçus : ..... 0
Nombre de messages ADS-B reçus erronés : .. 0
Récurrence, moyenne, écart-type : .....
Valeur 10%<, 10%> : .....

Altitude : .....

Nombre de squitters courts reçus : ..... 4
Nombre de squitters courts reçus erronés : .. 0 (0.000%)
Récurrence, moyenne, écart-type : ..... 0.950/s, 1.052s 0.112s
Valeur 10%<, 10%> : ..... 0.893s, 1.134s
Adresse : ..... 801C01

Control-----
Enter 0 to exit :

PCB Status-----
..

Current @-----
$801c01

Last @-----
(1) $801c01
(2) $000000
(3) $000000
(4) $000000
(5) $000000
(6) $000000
(7) $000000
(8) $000000

```

Figure 5 - ADS B Reception and CPR Decoding

```

File Edit Search Options                                Help
                                RESULT.REC
24->9333157C000000 99.9% 220000 Lbs
27->0000001F61F4C0 xxxx xxxx -40 °C -45 °C
2A->0000000000000000 xxxx xxxx
31->FF3B9999CCCC80 -2.29° 399.9 3999.9
40->CFDFC17F0DDC00
                                40880 Ft -2016 Ft/Min -5.625° 375.0 Kts 0 00 00 00 00
41->0000000000000000 xxxx xxxx xxxx xxxx xxxx xxxx
43->FF3CCCE6664000 -2.29° 99.9999.9
45->0000F4FD31F400 xxxx 58.38 hPa xxxx
50->881C013EA444E1
                                11.25° -90.00° 500 Kts 4.25°/s 450 Kts
10->0000000000000000 b s t 0 0 0 0 0 0 0 0 0 0 d p f c $00 $00
                                $00 $00 $00 $00 4 $00 $00 $00 $00 $00 $00 $00 $00 $00
17->0000001F61F4C0 xxxx xxxx -40 °C -45 °C

20->2000000000000000
21->D408E1221FA620 -123.75° 450 Kts 2112.0Ft/Min -45.0°C xxxx
24->9333157C000000 99.9% 220000 Lbs
27->0000001F61F4C0 xxxx xxxx -40 °C -45 °C
2A->0000000000000000 xxxx xxxx
31->FF3B9999CCCC80 -2.29° 399.9 3999.9
←                                     →
MS-DOS Editor <F1=Help> Press ALT to activate menus | 00338:001

```

Figure 6 - Result Recording of GICB Contents and Decoding in Engineering Units

```
File Edit Search Options                                Help
RESULT.REC
***** Squitter TEST *****
DF=17 AA= 801C01 0910 mV dT= 142.43349205 8B801C010000000000000000000000
DF=11 AA= 801C01 0650 mV dT= 0.00791055 5B801C01000000
DF=11 AA= 801C01 0670 mV dT= 0.43497285 5B801C01000000
DF=17 AA= 801C01 0700 mV dT= 0.09399135 8B801C010000000000000000000000
DF=17 AA= 801C01 0400 mV dT= 0.23879480 8B801C010000000000000000000000
DF=17 AA= 801C01 0740 mV dT= 0.07485335 8B801C010000000000000000000000
DF=11 AA= 801C01 0520 mV dT= 0.03269305 5B801C01000000
DF=17 AA= 801C01 0800 mV dT= 0.32174960 8B801C010000000000000000000000
DF=17 AA= 801C01 0650 mV dT= 0.51211435 8B801C010000000000000000000000
DF=11 AA= 801C01 0940 mV dT= 0.07410145 5B801C01000000
DF=17 AA= 801C01 1020 mV dT= 0.23938860 8B801C010000000000000000000000
DF=17 AA= 801C01 1060 mV dT= 0.36306615 8B801C010000000000000000000000
DF=17 AA= 801C01 0880 mV dT= 0.42938420 8B801C010000000000000000000000
DF=11 AA= 801C01 1010 mV dT= 0.07186165 5B801C01000000
DF=17 AA= 801C01 0870 mV dT= 0.48176010 8B801C010000000000000000000000
DF=17 AA= 801C01 0980 mV dT= 0.39603610 8B801C010000000000000000000000
DF=11 AA= 801C01 0830 mV dT= 0.03332805 5B801C01000000
DF=17 AA= 801C01 0770 mV dT= 0.32183865 8B801C010000000000000000000000
DF=17 AA= 801C01 0980 mV dT= 0.52841125 8B801C010000000000000000000000
DF=11 AA= 801C01 1010 mV dT= 0.33031415 5B801C01000000
MS-DOS Editor <F1=Help> Press ALT to activate menus 00001:001
```

Figure 7 - Recording of Squitter Data



**Figure 8 - Photo**

**Test Bench PC and Omnidirectional Antenna**





**Figure 9 - Photo**

**Test Bench, PC with Directional Antenna**

# A P P E N D I X

## C O N T E N T S

This Appendix shows details of all the GICB registers at present decoded by the test bench. Other registers may be added when they become available.

	Page No.
<b><i>Eurocontrol Format</i></b>	
BDS 1.0 - Capability Report	1
BDS 1.7 - Engine No. 1 Report	2
BDS 2.0 - Flight Identity	3
BDS 2.1 - Aircraft Referenced State Vector Report	4
BDS 2.4 - Weight and Balance Report	5
BDS 2.7 - Engine No. 2 Report	6
BDS 2.A - Radio System Frequency Report VHF	7
BDS 3.1 - Waypoint Information	8
BDS 3.7 - Engine No. 3 Report	9
BDS 4.0 - Path and Attitude Report	10
BDS 4.1 - Waypoint Identifier	11
BDS 4.7 - Engine No. 4 Report	12
BDS 5.0 - Speed and Track Report	13
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BDS 6.0 - Ground Referenced State Vector	15
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<b><i>Mode S Specific Services Format</i></b>	
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BDS 0.6 - Extended Squitter Surface Position	28
BDS 0.7 - Extended Squitter Status	29
BDS 1.0 - Data Link Capability Report	30
BDS 2.0 - Aircraft Identity	31
BDS 4.0 - Aircraft Intention	32
BDS 4.3 - Aircraft Intention	33
BDS 4.4 - Meteorological Routine Report	34
BDS 4.5 - Meteorological Hazard Report	35
BDS 5.0 - Track and Turn Report	36
BDS 5.1 - Position Report Coarse	37
BDS 5.2 - Position Report Fine	38
BDS 5.3 - Air-referenced State Vector	39
BDS 6.0 - Heading and Speed Report	40

# Mode-S Specific Services and Data Link Test Bench



## BDS 1.0 Capability Report

### Eurocontrol Format

Purpose: To provide the DLPU status.

Notes:

1) Bite test bit B definition

1 = Bite test successful.

0 = Bite test failure.

2) DLPU status LED bit definition

1 = LED on.

0 = LED off

3) BDS 20 output

1 = active

0 = not active

4) ADI channels active bits c1 to c10. ( 10 channels )

1 = channel active.

5) DLT ( cockpit Data Link Terminal ) bit d definition

1 = DLT present and on-line

6) MICP ( cockpit printer ) bit m definition

1 = printer present and on-line

7) GPFT ( General Purpose File Transfer ) g bit definition

1 = GPFT initialised and available

0 = GPFT not initialised.

8) Control unit bit u definition

1 = control unit connected

9) Aircraft type field tttt definition

Indicates type of aircraft field 0 to 15 which is hard wired on aircraft. This enables DLPU to process data from 15 different types of aircraft installations.

10) SAL Sytem Address Label field ssssssss definition.

The SAL can be hard wired on the aircraft. Value from 00 to FF hexadecimal. This is used by the file transfer facility.

BDS bit no.	Data bit no.	Description	Bit.
1		BDS 1,0	0
2			0
3			0
4			1
5			0
6			0
7			0
8			0
9		( Not used )	x
10			x
11			x
12			x
13			x
14		Bite test	B
15		Status LED	S
16		BDS 20 o/p	T
17		ADI Channels Active	c 1
18			c 2
19			c 3
20			c 4
21			c 5
22			c 6
23			c 7
24			c 8
25			c 9
26			c 10
27		DLT	d
28		MICP	m
29		GPFT	g
30		Not used	x
31			x
32			x
33			x
34			x
35		x	
36		Control unit	u
37		Aircraft type	msb t
38			t
39			t
40			lsb t
41		System Address Label	msb s
42			s
43			s
44			s
45			s
46			s
47			s
48			lsb s
49		Not used	x
50			x
51			x
52			x
53			x
54			x
55			x
56			x

# Mode-S Specific Services and Data Link Test Bench



## BDS 1,7 Engine No. 1 Report

### Eurocontrol Format

Status bit = 0 also if data too old.

BDS bit no.	Data bit no.	Description	ARINC bit no.
1	Status	1 = valid data	30&31
2			
3		msb = 128 %  N1 ACTUAL Label 346  Range = [0,256 %]	28
4			27
5			26
6			25
7			24
8			23
9			22
10			21
11			20
12			19
13			lsb = 128/1024 %
14	Status	1 = Valid data	30&31
15			
16		msb = 16384 lb/hr  FUEL FLOW Label 347 Range = 0, 32768 lb/hr	28
17			27
18			26
19			25
20			24
21			23
22			22
23			21
24			20
25			19
26			18
27		lsb = 8 lb/hr	17
28	Status	1 = Valid data	30&31
29	Sign	1 = -ve	29
30		msb = 256 C  TOTAL AIR TEMPERATURE Label 211  Range = +-512 deg C	28
31			27
32			26
33			25
34			24
35			23
36			22
37			21
38			20
39			msb = 0.5 C
40	Status	1 = Valid data	30&31
41	Sign	1 = -ve	29
42		msb = 256 C  STATIC AIR TEMPERATURE Label 213  Range = +- 512 C	28
43			27
44			26
45			25
46			24
47			23
48			22
49			21
50			20
51			lsb = 0.5 C
52			
53			
54			
55			
56			

## Mode-S Specific Services and Data Link Test Bench



### BDS 2.0 Flight Identity

#### Eurocontrol Format

Purpose: To report aircraft identification to the ground in accordance with Annex.10 Volume IV, section 3.1.2.9

Notes:

- 1) Annex 10, Volume IV, section 3.1.2.9 provides a full definition of BDS 2,0
- 2) The character coding to be used is identical to that defined in Table 3-6 of Chapter 3, Annex 10, Volume IV.
- 3) This data may be input to the transponder from sources other than the Mode S ADLP.
- 4) This format is used by the extended squitter application.

BDS bit no.	Data	Description	Bit
1		BDS Label 2,0	0
2			0
3			1
4			0
5			0
6			0
7			0
8			0
9		Character 1	
10			
11			see Note 2
12			
13		Character 2	
14			
15			
16			see Note 2
17		Character 3	
18			
19			
20			see Note 2
21		Character 4	
22			
23			
24			see Note 2
25		Character 5	
26			
27			
28			see Note 2
29		Character 6	
30			
31			
32			see Note 2
33		Character 7	
34			
35			
36			see Note 2
37		Character 8	
38			
39			
40			see Note 2
41		Character 9	
42			
43			
44			see Note 2
45		Character 10	
46			
47			
48			see Note 2
49		Character 11	
50			
51			
52			see Note 2
53		Character 12	
54			
55			
56			see Note 2

**BDS 2.1 Aircraft Referenced State Vector Report**

Eurocontrol Format

Status bit = 0 also if data too old.

BDS bit no.	Data bit no.	Description	ARINC bit no.
1	Status	1 = valid data	30&31
2	Sign		29
3		MAGNETIC HEADING  Label 320  Range = [+/-180 deg]  lsb = 0.18 deg	28
4			27
5			26
6			25
7			24
8			23
9			22
10			21
11			20
12			19
13	Status		30&31
14		TRUE AIR SPEED  Label 210  Range = [0,2048 kt]  lsb = 0.5 kt]	28
15			27
16			26
17			25
18			24
19			23
20			22
21			21
22			20
23			19
24		18	
25		17	
26			
27	Status		30&31
28	Sign		29
29		ALTITUDE RATE  Label 212 or 365  Range = [+/-16384 ft/min]  lsb = 64 ft/min	27
30			26
31			25
32			24
33			23
34			22
35			21
36			20
37	Status		30&31
38	Sign		29
39		STATIC AIR TEMPERATURE  Label 213  Range = [+/-512 °C]  lsb = 0.5 °C	28
40			27
41			26
42			25
43			24
44			23
45			22
46			21
47			20
48		19	
49	Status		30&31
50	Sign		29
51		NORMAL BODY ACCELERATION Label 333 Range = [+/-1g]  lsb = 0.16g	26
52			25
53			24
54			23
55			22
56		21	

**BDS 2.4 Weight and Balance Report**

Eurocontrol Format

Status bit = 0 also if data too old.

BDS bit no.	Data bit no.	Description	ARINC bit no.
1	Status	1 = valid data	30&31
2			
3			27
4			26
5			25
6			24
7			23
8			22
9			21
10		CENTRE OF GRAVITY	20
11		Label 066 ( BCD )	19
		Range = 0, 99.9 %	
12			18
13			17
14			16
15			15
16	Status	1 = valid data	30&31
17			
18		msb = 65536 lbs	28
19			27
20			26
21		GROSS WEIGHT	25
22		Label 075	24
23			23
24		Range = 0, 131072 lbs	22
25			21
26			20
27			19
28			18
29			17
30		msb = 16 lbs	16
31			
32			
33			
34			
35			
36			
37			
38			
39			
40			
41			
42			
43			
44			
45			
46			
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51			
52			
53			
54			
55			
56			

# Mode-S Specific Services and Data Link Test Bench



## BDS 2.7 Engine No. 2 Report

### Eurocontrol Format

Status bit = 0 also if data too old.

BDS bit no.	Data bit no.	Description	ARINC bit no.
1	Status	1 = valid data	30&31
2			
3		msb = 128 %  N1 ACTUAL Label 346  Range = [0,256 %]	28
4			27
5			26
6			25
7			24
8			23
9			22
10			21
11			20
12			19
13			lsb = 128/1024 %
14	Status	1 = Valid data	30&31
15			
16		msb = 16384 lb/hr  FUEL FLOW Label 347 Range = 0, 32768 lb/hr	28
17			27
18			26
19			25
20			24
21			23
22			22
23			21
24			20
25			19
26			18
27		lsb = 8 lb/hr	17
28	Status	1 = Valid data	30&31
29	Sign	1 = -ve	29
30		msb = 256 C  TOTAL AIR TEMPERATURE Label 211  Range = +-512 deg C	28
31			27
32			26
33			25
34			24
35			23
36			22
37			21
38			20
39			msb = 0.5 C
40	Status	1 = Valid data	30&31
41	Sign	1 = -ve	29
42		msb = 256 C  STATIC AIR TEMPERATURE Label 213  Range = +- 512 C	28
43			27
44			26
45			25
46			24
47			23
48			22
49			21
50			20
51			lsb = 0.5 C
52			
53			
54			
55			
56			



**Mode-S Specific Services and Data Link Test Bench**



**BDS 2.A Radio System Frequency Report VHF**

Eurocontrol Format

Status bit = 0 also if data too old.

BDS bit no.	Data bit no.	Description	ARINC bit no.
1	Status	1 = valid data	30&31
2			28
3		10 Mhz	27
4			26
5			25
6			24
7		1 Mhz	23
8			22
9		VHF COM 1	21
10		Label 030 ( BCD )	20
11		0.1 Mhz	19
12			18
13			17
14			16
15		0.01 Mhz	15
16	Status	1 = valid data	30&31
17			28
18		10 Mhz	27
19			26
20			25
21			24
22		1 Mhz	23
23			22
24		VHF COM 2	21
25		Label 030 ( BCD )	20
26		0.1 Mhz	19
27			18
28			17
29			16
30		0.01 Mhz	15
31			
32			
33			
34			
35			
36			
37			
38			
39			
40			
41			
42			
43			
44			
45			
46			
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52			
53			
54			
55			
56			

**BDS 3.1 Waypoint Information**

Eurocontrol Format

Status bit = 0 also if data too old.

BDS bit no.	Data bit no.	Description	ARINC bit no.
1	Status	1 = valid data	30&31
2	Sign		29
3		BEARING TO WAYPOINT  Label 115  Range =[ +-180 deg ]  lsb = 0.18 deg ]	28
4			27
5			26
6			25
7			24
8			23
9			22
10			21
11			20
12			19
13	Status		30&31
14		TIME TO GO  Label 002 BCD  Range = [0,399.9 min]	29
15			28
16			27
17			26
18			25
19			24
20			23
21			22
22			21
23			20
24		19	
25		18	
26		17	
27		16	
28		15	
29	Status		
30		DISTANCE TO GO BCD Label 001  Range = [0,3999.9 nm]	
31			29
32			28
33			27
34			26
35			25
36			24
37			23
38			22
39			21
40		20	
41		19	
42		18	
43		17	
44		16	
45		15	
46		14	
47		13	
48		12	
49		11	
50		SPARE	
51			
52			
53			
54			
55			
56			

Mode-S Specific Services and Data Link Test Bench



**BDS 3, 7 Engine No. 3 Report**

Eurocontrol Format

Status bit = 0 also if data too old.

BDS bit no.	Data bit no.	Description	ARINC bit no.
1	Status	1 = valid data	30&31
2			
3		msb = 128 %  N1 ACTUAL Label 346  Range = [0,256 %]	28
4			27
5			26
6			25
7			24
8			23
9			22
10			21
11			20
12			19
13			lsb = 128/1024 %
14	Status	1 = Valid data	30&31
15			
16		msb = 16384 lb/hr  FUEL FLOW Label 347 Range = 0, 32768 lb/hr	28
17			27
18			26
19			25
20			24
21			23
22			22
23			21
24			20
25			19
26			18
27		lsb = 8 lb/hr	17
28	Status	1 = Valid data	30&31
29	Sign	1 = -ve	29
30		msb = 256 C  TOTAL AIR TEMPERATURE Label 211  Range = +-512 deg C	28
31			27
32			26
33			25
34			24
35			23
36			22
37			21
38			20
39			msb = 0.5 C
40	Status	1 = Valid data	30&31
41	Sign	1 = -ve	29
42		msb = 256 C  STATIC AIR TEMPERATURE Label 213  Range = +- 512 C	28
43			27
44			26
45			25
46			24
47			23
48			22
49			21
50			20
51			lsb = 0.5 C
52			
53			
54			
55			
56			

**BDS 4,0 Path & Attitude Report**

Eurocontrol Format

Status bit = 0 also if data too old.

BDS	Data	Description	ARINC
1	Status	1 = valid data	30&31
2	Sign		29
3		msb=90 deg	28
4			27
5			26
6		FLIGHT PATH ANGLE	25
7		Label 322	24
8			23
9		Range = [+-180 deg ]	22
10			21
11			20
12		lsb=0.18 deg	19
13	Status	1 = valid data	30&31
14	Sign		29
15		msb = 2g	28
16			27
17			26
18		FLIGHT PATH ACCEL.	25
19		Label 323	24
20			23
21		Range = [+-4g ]	22
22			21
23			20
24			19
25			18
26		lsb=0.001g	17
27	Status	1 = valid data	30&31
28	Sign		29
29		msb=90 deg	28
30			27
31			26
32			25
33		CORRECTED ANGLE	24
34		OF ATTACK	23
35		Label 241	22
36			21
37		Range = [+- 180 ]	20
38			19
39			18
40		lsb=0.044 deg	17
41	Status	1 = valid data	30&31
42	Sign		29
43		msb=65,536 ft	28
44			27
45			26
46			25
47		BARO. CORRECTED	24
48		ALTITUDE	23
49		Label 204	22
50			21
51		Range [ 0,131072 ft]	20
52			19
53			18
54			17
55			16
56		lsb = 8 ft	15

**BDS 4.1 Waypoint Identifier**

Eurocontrol Format

Status bit = 0 also if data too old.

BDS bit no.	Data bit no.	Description	ARINC bit no.
1	Status	1 = valid data	30&31
2			29
3			28
4			27
5			26
6			25
7			24
8			23
9		char 3	22
10		ACTIVE WAYPOINT 1 Label 356 ISO 5 Characters	21
11			20
12			19
13			18
14			17
15		char 2	16
16			15
17			14
18			13
19			12
20			11
21			10
22			char 1
23	Status	1 = valid data	30&31
24			29
25			28
26			27
27			26
28			25
29			24
30		char 6	23
31		ACTIVE WAYPOINT 2 Label 357 ISO 5 Characters	22
32			21
33			20
34			19
35			18
36		char 5	17
37			16
38			15
39			14
40			13
41			12
42			11
43			10
44		char4	9
45	Status	1 = valid	30&31
46	Sign	1 = west	29
47		msb = 90 deg	28
48			27
49		DESIRED TRACK Label 114 Range = +- 180 deg	26
50			25
51			24
52			23
53			22
54			21
55			20
56		lsb = 90/512 deg	19

**BDS 4, 7 Engine No. 4 Report**

Eurocontrol Format

Status bit = 0 also if data too old.

BDS bit no.	Data bit no.	Description	ARINC bit no.
1	Status	1 = valid data	30&31
2			
3		msb = 128 %  N1 ACTUAL Label 346  Range = [0,256 %]	28
4			27
5			26
6			25
7			24
8			23
9			22
10			21
11			20
12			19
13			lsb = 128/1024 %
14	Status	1 = Valid data	30&31
15			
16		msb = 16384 lb/hr  FUEL FLOW Label 347 Range = 0, 32768 lb/hr	28
17			27
18			26
19			25
20			24
21			23
22			22
23			21
24			20
25			19
26			18
27		lsb = 8 lb/hr	17
28	Status	1 = Valid data	30&31
29	Sign	1 = -ve	29
30		msb = 256 C  TOTAL AIR TEMPERATURE Label 211  Range = +-512 deg C	28
31			27
32			26
33			25
34			24
35			23
36			22
37			21
38			20
39			msb = 0.5 C
40	Status	1 = Valid data	30&31
41	Sign	1 = -ve	29
42		msb = 256 C  STATIC AIR TEMPERATURE Label 213  Range = +- 512 C	28
43			27
44			26
45			25
46			24
47			23
48			22
49			21
50			20
51			lsb = 0.5 C
52			
53			
54			
55			
56			

**BDS 5.0 Speed & Track Report**

Eurocontrol Format

Status bit = 0 also if data too old.

BDS	Data	Description	ARINC	
1	Status	1 = valid data	30&31	
2				
3		msb = 2.048  MACH NUMBER Label 205  Range = [ 0, 4.096 ]  lsb = 2.048/2048 = 0.001	28	
4			27	
5			26	
6			25	
7			24	
8			23	
9			22	
10			21	
11			20	
12			19	
13			18	
14			17	
15	Status		1 = valid data	30&31
16				
17		msb = 512 kt  COMPUTED AIR Label 206  Range = [ 0, 1023.5 ]  lsb = 0.5 kt	28	
18			27	
19			26	
20			25	
21			24	
22			23	
23			22	
24			21	
25			20	
26			19	
27			18	
28	Status	1 = valid data	30&31	
29	Sign	1 = westward	29	
30		msb = 90 deg.  TRACK ANGLE TRUE Label 313  Range = [ -180,+180 ]  lsb = 0.044 deg	28	
31			27	
32			26	
33			25	
34			24	
35			23	
36			22	
37			21	
38			20	
39			19	
40			18	
41			17	
42	Status		1 = valid data	30&31
43	Sign	1 = westward	29	
44		msb = 90 deg  TRACK ANGLE MAGNETIC Label 317  Range = [ -180,+180 ]  lsb = 0.044 deg	28	
45			27	
46			26	
47			25	
48			24	
49			23	
50			22	
51			21	
52			20	
53			19	
54			18	
55			17	
56				





**BDS 6,0 Ground Referenced State Vector**

Eurocontrol Format

Status bit = 0 also if data too old.

BDS	Data	Description	ARINC	
1	Status	1 = valid data	30&31	
2	Sign	1 = westward	29	
3		TRACK ANGLE MAGNETIC Label 317 Range = [ -180, +180 ] lsb=0.18 deg	28	
4			27	
5			26	
6			25	
7			24	
8			23	
9			22	
10			21	
11			20	
12			19	
13	Status		1 = valid data	30&31
14				
15		GROUND SPEED Label 312 Range = [ 0, 2048 kt ] lsb=0.5 kt	27	
16			26	
17			25	
18			24	
19			23	
20			22	
21			21	
22			20	
23			19	
24			18	
25			17	
26		16		
27	Status	1 = valid data	30&31	
28	Sign		29	
29		ALTITUDE RATE Label 212 or 365 Range = [ +-16384 ft/m ] lsb=64 ft/min	27	
30			26	
31			25	
32			24	
33			23	
34			22	
35			21	
36			20	
37	Status	1 = valid data	30&31	
38	Sign		29	
39		STATIC AIR TEMP. Label 213 Range = [ +-512 deg ] lsb=0.5 deg	28	
40			27	
41			26	
42			25	
43			24	
44			23	
45			22	
46			21	
47			20	
48		19		
49	Status	1 = valid data	30&31	
50	Sign		29	
51		BODY NORMAL ACCELERATION Label 333 Range = [ +-1g ] msb=0.5g msb=0.016g	26	
52			25	
53			24	
54			23	
55			22	
56		21		

**Mode-S Specific Services and Data Link Test Bench**



**BDS 6.1 G.M.T. Report**

Eurocontrol Format

Status bit = 0 also if data too old.

BDS bit no.	Data bit no.	Description	ARINC bit no.
1	Status	1 = valid data	30&31
2			
3		Hrs 0 -23	28
4			27
5			26
6			25
7			24
8		GMT Binary Word Label 150 Minutes 0 - 59	23
9			22
10			21
11			20
12			19
13		Seconds 0 - 59	18
14			17
15			16
16			15
17			14
18			13
19			12
20	Status	1 = valid data	30&31
21			29
22			28
23			27
24			26
25		FLIGHT NUMBER (BCD) Label 261	25
26			24
27			23
28			22
29			21
30			20
31			19
32			18
33			17
34			16
35			15
36			14
37	Status	1 = valid data	30&31
38			29
39			28
40			27
41		GMT BCD Word Label 125	26
42			25
43			24
44			23
45			22
46			21
47			20
48			19
49			18
50			17
51			16
52			15
53			14
54			13
55			12
56			11

**BDS 7.0 Aircraft Intention 1 Report**

Eurocontrol Format

Status bit = 0 also if data too old.

BDS bit no.	Data bit no.	Description	ARINC bit no.
1	Status	1 = valid data	30&31
2			
3		SELECTED ALTITUDE Label 102  Range = [0,65536 ft]	28
4			27
5			26
6			25
7			24
8			23
9			22
10			21
11			20
12			19
13			18
14			lsb = 16 ft
15	Status	1 = Valid data	30&31
16	Sign		29
17		SELECTED HEADING Label 101  Range = [+/-180 deg]	28
18			27
19			26
20			25
21			24
22			23
23			22
24			lsb = 0.8 deg
25	Status		30&31
26		STATUS WORD 1 Label 270  Discrete data	25
27			24
28			23
29			22
30			21
31			20
32			19
33			18
34			17
35			16
36			15
37			14
38			13
39			12
40			11
41	Status		30&31
42		STATUS WORD 2 Label 271  Discrete data	27
43			26
44			25
45			24
46			23
47			22
48			21
49			20
50			19
51			18
52			17
53			16
54			15
55			14
56			13

**BDS 7.1 Meteorological Report**

Eurocontrol Format

Status bit = 0 also if data too old.

BDS bit no.	Data bit no.	Description	ARINC bit no.
1	Status	1 = valid data	30&31
2	Sign	1 = left wing down	29
3		msb = 45 deg	27
4			26
5		ROLL ANGLE	25
6		Label 325	24
7			23
8		Range = [ +-90 deg ]	22
9			21
10		lsb = 45/128 deg	20
11	Status	1 = valid data	30&31
12	Sign	1 = down	29
13		msb = 4096 ft/min	26
14		ALTITUDE RATE or	25
15		INERTIAL VERTICAL VEL.	24
16		Label 212 or 365	23
17		Range +-8192 ft/min	22
18		lsb = 128 ft/min	21
19	Status	1 = valid data	30&31
20			29
21		msb = 128 kt	28
22			27
23		WIND SPEED	26
24		Label 315	25
25			24
26		Range = 0,256 kt	23
27			22
28		lsb = 1 kt	21
29	Status	1 = valid data	30&31
30	Sign	1 = west	29
31		msb = 90 deg	28
32			27
33		WIND ANGLE	26
34		Label 316	25
35			24
36		Range = +-180 deg	23
37			22
38		lsb = 90/1218 deg	21
39	Status	1 = valid data	30&31
40	Sign	1 = -ve	29
41		msb = 256 C	28
42		STATIC AIR	27
43		TEMPERATURE	26
44		Label 213	25
45			24
46		Range +- 512 deg C	23
47			22
48			21
49			20
50		lsb = 0.5 C	19
51	Status	1 = valid data	30&31
52	Sign	1 = -ve	29
53		msb = 0.5 g	26
54		ACCELERATION	25
55		Label 333	24
56		lsb = 1/16 g	23

**BDS 8.0 Aircraft Intention 2 Report**

Eurocontrol Format

Status bit = 0 also if data too old.

BDS bit no.	Data bit no.	Description	ARINC bit no.	
1	Status	1 = valid data	30&31	
2				
3		msb = 256 kt  SELECTED AIR SPEED Label 103  Range = [0,512 kt]	28	
4			27	
5			26	
6			25	
7			24	
8			23	
9			22	
10			21	
11			20	
12			19	
13			lsb = 0.25 kt	18
14	Status	1 = Valid data	30&31	
15	Sign	1 = down	29	
16		msb = 8192  SELECTED ALTITUDE RATE Label 104 Range = [+16384 ft/min]	28	
17			27	
18			26	
19			25	
20			24	
21			23	
22			22	
23			21	
24			20	
25			lsb = 16 ft/min	19
26	Status			30&31
27		msb = 32768 ft  SELECTED ALTITUDE Label 102  Range = 0, 65536 ft		
28			28	
29			27	
30			26	
31			25	
32			24	
33			23	
34			22	
35			21	
36			20	
37			19	
38			18	
39			msb = 16 ft	17
40	Status		30 & 31	
41		STATUS WORD 1 Label 270  Discrete data		
42			25	
43			24	
44			23	
45			22	
46			20	
47			15	
48			14	
49			13	
50				
51	Status		30 & 31	
52		STATUS WORD 2 Label 271  Discrete data		
53			27	
54			22	
55			21	
56			20	

Mode-S Specific Services and Data Link Test Bench



**BDS 9, 0 Aircraft Intention 3 Report**

Eurocontrol Format

Status bit = 0 also if data too old.

BDS bit no.	Data bit no.	Description	ARINC bit no.
1	Status	1 = valid data	30&31
2			
3		msb = 2048 mM  SELECTED MACH Label 106  Range = [0,4096 mM]	28
4			27
5			26
6			25
7			24
8			23
9			22
10			21
11			20
12			19
13			lsb = 2 mM
14	Status	1 = Valid data	30&31
15	Sign	1 = down	29
16		msb = 8192  SELECTED ALTITUDE RATE Label 104 Range = [+16384 ft/min]	28
17			27
18			26
19			25
20			24
21			23
22			22
23			21
24			20
25			lsb = 16 ft/min
26	Status		30&31
27		msb = 32768 ft  SELECTED ALTITUDE Label 102  Range = 0, 65536 ft	
28			28
29			27
30			26
31			25
32			24
33			23
34			22
35			21
36			20
37			19
38			18
39			msb = 16 ft
40	Status		30 & 31
41		STATUS WORD 1 Label 270  Discrete data	
42			25
43			24
44			23
45			22
46			20
47			15
48			14
49			13
50			
51	Status		30 & 31
52		STATUS WORD 2 Label 271  Discrete data	
53			27
54			22
55			21
56			20

**BDS A,0 Deviation Report**

Eurocontrol Format

Status bit = 0 also if data too old.

BDS bit no.	Data bit no.	Description	ARINC bit no.
1	Status	1 = valid data	30&31
2	Sign		29
3		msb = 64 nm  CROSS TRACK ERROR Label 116  Range =[ 0, 128 mn] ]  lsb =0.004 nm	28
4			27
5			26
6			25
7			24
8			23
9			22
10			21
11			20
12			19
13			18
14			17
15			16
16			15
17		14	
18	Status	1 = valid data	30&31
19	Sign	1 = low	29
20		msb = 1024 ft  VERTICAL DEVIATION Label 117  Range = 0, 2048 ft  lsb = 1 ft	28
21			27
22			26
23			25
24			24
25			23
26			22
27			21
28			20
29			19
30			18
31	Status	1 = valid data	30&31
32	Sign	1 = -ve	29
33		msb = 0.5 g  BODY NORMAL ACCELERATION Label 333 Range = +- 1g lsb = 1/64 g	26
34			25
35			24
36			23
37			22
38		21	
39			
40			
41			
42			
43			
44			
45			
46			
47			
48			
49			
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51			
52			
53			
54			
55			
56			

**BDS B.0    Airspeeds Report**

Eurocontrol Format

Status bit = 0 also if data too old.

BDS bit no.	Data bit no.	Description	ARINC bit no.
1	Status	1 = valid data	30&31
2			
3		msb = 512 kt	28
4			27
5		COMPUTED AIR SPEED	26
6		Label 206	25
7			24
8		Range =[ 0, 1024 kt ]	23
9			22
10			21
11			20
12			19
13			18
14		lsb = 0.25 kt	17
15	Status	1 = valid data	30&31
16			
17		msb = 1024 kt	28
18			27
19		TRUE AIR SPEED	26
20		Label 210	25
21			24
22		Range =[ 0, 2048 kt ]	23
23			22
24			21
25			20
26			19
27			18
28		lsb = 0.5 kt	17
29	Status	1 = valid data	30&31
30			
31		msb = 2048 mM	28
32			27
33		MACH	26
34		Label 205	25
35			24
36		Range =[ 0, 4.096 ]	23
37			22
38			21
39			20
40			19
41			18
42			17
43			16
44		lsb = 0.00025	15
45	Status	1 = valid data	30&31
46	Sign	1 = west	29
47		msb = 90 deg	28
48			27
49		MAGNETIC HEADING	26
50		Label 320	25
51			24
52		Range =[+-180 deg ]	23
53			22
54			21
55			20
56		lsb = 90/512 deg	19



Mode-S Specific Services and Data Link Test Bench



**BDS C,0 Altitude Report**

Eurocontrol Format

Status bit = 0 also if data too old.

BDS bit no.	Data bit no.	Description	ARINC bit no.
1	Status	1 = valid data	30&31
2			
3		msb = 4096 ft  RADIO HEIGHT Label 164  Range = 0, 8192 ft	28
4			27
5			26
6			25
7			24
8			23
9			22
10			21
11			20
12			19
13			18
14			17
15			lsb = 1 ft
16	Status	1 = valid data	30&31
17			
18		msb = 512 mb  AVERAGE STATIC PRESSURE Label 246  Range 0,1024 mb	27
19			26
20			25
21			24
22			23
23			22
24			21
25			20
26			19
27			18
28			17
29			lsb = 0.25 mb
30	Status	1 = valid data	30&31
31			
32		msb = 65536 ft  ALTITUDE Label 203  Range = 0, 131072 ft	28
33			27
34			26
35			25
36			24
37			23
38			22
39			21
40			20
41			19
42			18
43			17
44			16
45			15
46			14
47			13
48			lsb = 1 ft
49			
50			
51			
52			
53			
54			
55			
56			

**BDS D,0 Intention Report 1**

Eurocontrol Format

Status bit = 0 also if data too old.

BDS	Data	Description	ARINC
1	Status	1 = valid data	30&31
2	Sign		29
3		msb 90 deg  SELECTED COURSE Label 100 Range [+180 deg ]	28
4			27
5			26
6			25
7			24
8			23
9			22
10			lsb 0.7 deg
11	Status	1 = valid data	30&31
12	Sign		29
13		msb 90 deg  SELECTED HEADING Label 101 Range [+180 deg ]	28
14			27
15			26
16			25
17			24
18			23
19			22
20			lsb 0.7 deg
21	Status	1 = valid data	30&31
22	Sign		29
23		msb 32 768 ft  SELECTED ALTITUDE Label 102 Range [0,65 536 ft]	28
24			27
25			26
26			25
27			24
28			23
29			22
30			21
31			20
32			19
33			18
34			lsb 16 ft
35	Status	1 = valid data	30&31
36	Sign		29
37		msb 90 deg  DESIRED TRACK Label 114 Range [+180 deg ]	28
38			27
39			26
40			25
41			24
42			23
43			22
44			lsb 0.7 deg
45	Status	1 = valid data	30&31
46	Sign		29
47		msb 16339 ft/min  INERTIAL VERTICAL VELOCITY Label 365 Range [0,32678 ft/min]	28
48			27
49			26
50			25
51			24
52			23
53			22
54			21
55			20
56			lsb = 32 ft/min

**BDS D.1 Turn Indication Report 1**

Eurocontrol Format

Status bit = 0 also if data too old.

BDS bit no.	Data bit no.	Description	ARINC bit no.
1	Status	1 = valid data	30&31
2	Sign		29
3		msb 22.5 deg	26
4		ROLL ANGLE	25
5		Label 325	24
6		Range [+ 45 deg ]	23
7			22
8		lsb 0.7 deg	21
9	Status	1 = valid data	30&31
10	Sign		29
11		msb 56 deg/sec	28
12			27
13		ROLL RATE	26
14		Label 327	25
15		Range [0,128 deg/sec]	24
16			23
17		lsb 1 deg/sec	22
18	Status	1 = valid data	30&31
19	Sign		29
20		msb 16 deg/sec	28
21			27
22		TRACK ANGLE RATE	26
23		Label 335	25
24		Range [ +- 32 deg/sec	24
25			23
26		lsb 0.25 deg/sec	22
27	Status	1 = valid data	30&31
28	Sign		29
29		msb 90 deg	28
30			27
31			26
32		MAGNETIC HEADING	25
33		Label 320	24
34		Range [+180 deg]	23
35			22
36			21
37			20
38			19
39			18
40		lsb 0.044 deg	17
41	Status	1 = valid data	30&31
42		msb 0.25 g	25
43			24
44		CROSS TRACK ACCEL	23
45		Label 363	22
46		Range [0,0.5g]	21
47			20
48		lsb 0.004g	19
49	Status	1 = valid data	30&31
50		msb 0.25 g	25
51			24
52		CROSS HEAD. ACCEL	23
53		Label 376	22
54		Range [0,0.5g]	21
55			20
56		lsb 0.004g	19

**BDS D,2 Turn Indication Report 2**

Eurocontrol Format

Status bit = 0 also if data too old.

BDS	Data	Description	ARINC
1	Status	1 = valid data	30&31
2	Sign		29
3		msb 22.5 deg	26
4		ROLL ANGLE	25
5		Label 325	24
6		Range [+ 45 deg ]	23
7			22
8		lsb 0.7 deg	21
9			30&31
10			29
11		msb 56 deg/sec	28
12			27
13		ROLL RATE	26
14		Label 327 or 337	25
15		Range [128 deg/sec]	24
16			23
17		lsb 1 deg/sec	22
18	Status	1 = valid data	30&31
19	Sign		29
20			28
21			27
22		TRACK ANGLE RATE	26
23		Label 335	25
24		Range [ 0,32 deg/sec]	24
25			23
26			22
27	Status	1 = valid data	30&31
28	Sign		29
29		msb 90 deg	28
30			27
31			26
32			25
33		TRACK ANGLE TRUE	24
34		Label 313	23
35		Range [+180 deg]	22
36			21
37			20
38			19
39			18
40		lsb 0.044 deg	17
41	Status	1 = valid data	30&31
42		msb 0.25 g	25
43			24
44		CROSS TRACK ACCEL	23
45		Label 363	22
46		Range [0,0.5g]	21
47			20
48		lsb 0.004 g	19
49	Status	1 = valid data	30&31
50		msb 0.25 g	25
51			24
52		CROSS HEAD. ACCEL	23
53		Label 376	22
54		Range [0,0.5g]	21
55			20
56		lsb 0.004 g	19





**BDS 0.6 Extended Squitter Surface Position**

ModeS Specific Service Format

**PURPOSE:** To provide accurate position information.

TYPE coding values :

- 0 No position information
  - 1 Identification (aircraft type set D)
  - 2 Identification (aircraft type set C)
  - 3 Identification (aircraft type set B)
  - 4 Identification (aircraft type set A)
  - 5 Surface position  $\mu \leq 2m$  (0.001 nm)
  - 6 Surface position  $2m < \mu \leq 18 m$  (0.01 nm)
  - 7 Surface position  $18m < \mu \leq 185 m$  (0.1 nm)
  - 8 Surface position  $185 m < \mu$
  - 9 Airborne position \*  $\mu \leq 2m$  (0.001 nm)
  - 10 Airborne position \*  $2m < \mu \leq 18 m$  (0.01 nm)
  - 11 Airborne position \*  $18m < \mu \leq 185 m$  (0.1 nm)
  - 12 Airborne position \*  $185 m < \mu \leq 740m$  (0.4 nm)
  - 13 Airborne position \*  $740m < \mu \leq 1.85km$  (1 nm)
  - 14 Airborne position \*  $1.85km < \mu \leq 7.4km$  (4 nm)
  - 15 Airborne position \*  $7.4km < \mu \leq 18.5 km$  (10 nm)
  - 16 Airborne position \*  $18.5km < \mu$
  - 17 Airborne position #  $\mu \leq 18 m$  (0.01nm)
  - 18 Airborne position #  $18 m < \mu$
  - 19 Airborne velocity information
  - 20-28 Unassigned
  - 29 Event-driven message C
  - 30 Event-driven message B
  - 31 Event-driven message A
- \* = 25/100 ft barometric altitude  
 # = GNSS height ( TBD )  
 $\mu$  = Horizontal position accuracy ( 95% containment value)

Movement values:

- 0 no information available
- 1 aircraft stopped ( ground speed  $< 0.125 kt$  )
- 2-8  $0.125 kt (0.23 km/h) \leq$  ground speed  $< 1 kt$  in 0.125 kt steps
- 9-12  $1 kt (1.80 km/h) \leq$  ground speed  $< 2 kt$  in 0.25 kt steps
- 13-38  $2 kt (3.70 km/h) \leq$  ground speed  $< 15 kt$  in 0.5 kt steps
- 39-93  $15 kt (28 km/h) \leq$  ground speed  $< 70 kt$  in 1 kt steps
- 94-108  $70 kt (130 km/h) \leq$  ground speed  $< 100 kt$  in 2 kt steps
- 109-123  $100 kt (185 km/h) \leq$  ground speed  $< 175 kt$  in 5 kt steps
- 124 ground speed  $\geq 175 kt(324 km/h)$
- 125 Reserved for aircraft deceleration
- 126 Reserved for aircraft acceleration
- 127 Reserved for aircraft backing up

BDS bit no.	Description
1	TYPE
2	
3	
4	
5	
6	MOVEMENT
7	
8	
9	
10	
11	
12	
13	Sign bit ground track
14	GROUND TRACK TRUE All zeros = no information Range = 0, 180 degs
15	
16	
17	
18	
19	resolution = 180/64 deg
20	Unassigned
21	Unassigned
22	CPR Format/Time
23	msb  ENCODED LATITUDE  Using CPR surface algorithm
24	
25	
26	
27	
28	
29	
30	
31	
32	
33	
34	
35	
36	
37	
38	
39	lsb
40	msb  ENCODED LONGITUDE  Using CPR surface algorithm
41	
42	
43	
44	
45	
46	
47	
48	
49	
50	
51	
52	
53	
54	
55	
56	lsb



**BDS 0.7 Extended Squitter Status**

ModeS Specific Service Format

**PURPOSE:** To provide information on the capability and status of the extended squitter rate of the transponder.

Transmission rate subfield coding:

- 0 = No capability to determine surface squitter rate.
- 1 = High surface squitter rate selected.
- 2 = Low surface squitter rate selected.
- 3 = Unassigned

Altitude type subfield (ATS) coding :

- 0 = Barometric altitude.
- 1 = GNSS height.

*Note : Aircraft determination of surface squitter rate.*

*For aircraft that have the capability to automatically determine their surface squitter rate, the method that must be used to switch between high and low transmission rates is as follows :*

- a) *Switching from high to low rate:*
- b) *Switching from low to high rate:*

*I) the aircraft's position has changed by 10 metres or more since the low rate was selected; or*

*ii) the aircraft's ground speed exceeds one knot.*

BDS bit no.	Description
1	TRANSMISSION RATE SUBFIELD (TRS)
2	
3	ATS Altitude type subfield
4	
5	
6	
7	
8	
9	
10	
11	
12	
13	
14	
15	
16	
17	
18	
19	
20	
21	
22	
23	
24	
25	
26	
27	
28	
29	
30	
31	
32	
33	
34	
35	
36	
37	
38	
39	
40	
41	
42	
43	
44	
45	
46	
47	
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55	
56	



**BDS 1.0 Data Link Capability Report**

ModeS Specific Service Format

**Purpose:** To report the data link capability of the Mode S transponder /data link installation, in accordance with section 5.2.9 of the Mode S subnetwork SARPs ( see paragraph 1.8 ).

Notes :

1) The Mode S subnetwork SARPs must be consulted for the full definition of BDS 1,0.

2) Bit 25 is used as a status bit for all BDS buffers.

3) Starting from the Msb, each subsequent bit position represents the DTE subaddresses in the range from 0 to 15.

4) The enhanced protocol indicator denotes a Level 5 transponder when set to 1 and a Level 2 to 4 transponder when set to 0.

5) The squitter capability subfield (SCS) is interpreted as follows:

0 = squitter registers are not updated

1 = squitter registers are being updated.

6) The surveillance identifier (SI) bit is interpreted as follows:

0 = no surveillance identifier code capability

1 = surveillance identifier code capability

7) Bit 36 is toggled to indicate that the common usage GICB capability report (BDS 17) has changed. To avoid the generation of too many broadcast capability report changes, BDS 1,7 should be sampled at approximately one-minute intervals to check for changes.

BDS bit no.	Data	Description	Bit	
1		BDS Label 1,0	0	
2			0	
3			0	
4			1	
5			0	
6			0	
7			0	
8			0	
9		Continuation flag		
10				
11				
12				
13				
14				
15				
16		Reserved for ACAS		
17		Mode S subnetwork version number		
18				
19				
20				
21				
22				
23				
24		Transponder enhanced protocol indicator	Note 4	
25		ModeS specific services capability		
26		Uplink ELM capability		
27				
28				
29		Downlink ELM capability		
30				
31				
32				
33		Aircraft Identification capability		
34		Squitter capability subfield(SCS)	Note 5	
35		Surveillance identifier	Note 6	
36		Common usage GICB capability report	Note 7	
37		Reserved for ACAS		
38				
39				
40				
41		Msb		
42		Bit array indicating the support status of DTE subaddresses 0 to 15		
43				
44				
45				
46				
47				
48				
49				
50				
51				
52				
53				
54				
55				
56			Lsb	





**BDS 2.0 Aircraft Identity**

ModeS Specific Service Format

Purpose: To report aircraft identification to the ground in accordance with Annex.10 Volume IV, section 3.1.2.9

Notes:

1) Annex 10, Volume IV, section 3.1.2.9 provides a full definition of BDS 2,0

2) The character coding to be used is identical to that defined in Table 3-6 of Chapter 3, Annex 10, Volume IV.

3) This data may be input to the transponder from sources other than the Mode S ADLP.

4) This format is used by the extended squitter application.

BDS bit no.	Data	Description	Bit
1		BDS Label 2,0	0
2			0
3			1
4			0
5			0
6			0
7			0
8			0
9		Character 1	
10			
11			see Note 2
12			
13		Character 2	
14			
15			see Note 2
16			
17		Character 3	
18			
19			see Note 2
20			
21		Character 4	
22			
23			see Note 2
24			
25		Character 5	
26			
27			see Note 2
28			
29		Character 6	
30			
31			see Note 2
32			
33		Character 7	
34			
35			see Note 2
36			
37		Character 8	
38			
39			see Note 2
40			
41		Character 9	
42			
43			see Note 2
44			
45		Character 10	
46			
47			see Note 2
48			
49		Character 11	
50			
51			see Note 2
52			
53		Character 12	
54			
55			see Note 2
56			



**BDS 4.0 Aircraft intention**

**Purpose:** To provide ready access to information about an aircraft’s short-term intentions, in order to improve the effectiveness of conflict probes and to provide additional tactical information to controllers.

*Notes:*

1) The data entered into this register should be derived from the sources that are controlling the aircraft.

2) Selected course/heading and selected airspeed/mach are switchable, with an extra switch bit to indicate which parameter is in use. It is defined as follows:

SWITCH bit	0	1
Course/heading	Course	Heading
Airspeed/Mach	Airspeed	Mach

BDS bit no.	Data	Description	ARINC bit no.
1	Status	1 = valid data	30&31
2	Sign	msb = 32768 ft	28
3			27
4		SELECTED ALTITUDE	26
5		Label 102	25
6			24
7		Range = [ 0, 65520 ft ]	23
8			22
9			21
10			20
11			19
12			18
13		lsb = 16 ft	17
14		1 = valid data	30&31
15		Sign 1 = minus	29
16		msb = 8192 ft/min	27
17			26
18		SELECTED ALTITUDE	25
19		RATE	24
20		Label 104	23
21			22
22		Range = [+ - 16352 ft/min ]	21
23			20
24		lsb = 32 ft/min	19
25		SWITCH	
26		STATUS	30&31
27		SIGN	29
28		msb = 90 deg	28
29			27
30		SELECTED MAGNETIC	26
31		COURSE / HEADING	25
32		Label 100 / 101	24
33		Range = [+ -180 deg]	23
34			22
35		lsb = 360/512 deg	21
36		SWITCH	
37		STATUS	30&31
38		msb = 256 kt/Mach 2048	27
39			26
40		SELECTED	25
41		AIRSPEED/MACH	24
42		Label 103 / 106	23
43			22
44		Range = [ 0,512 kt]	21
45		or [0,4.096 Mach]	20
46			19
47		lsb = 0.5 kt/Mach 0.004	18
48		STATUS of MODE Fields	
49		MODE	
50		SELECTED ALTITUDE	
51		MODE	
52		SELECTED ALTITUDE RATE	
53		MODE	
54		SELECT. COURSE/HEADING	
55		MODE	
56		SELECTED AIRSPEED/MACH	



**BDS 4.3 Aircraft intention**

ModeS Specific Service Format

Purpose: To provide ready access to details about the next waypoint on an aircraft’s route, without the need to establish a data link dialogue with the flight management system. This will assist with short and medium term tactical control.

*Note:*

*Time to go and Distance to go are Binary Coded Decimal values, where each decimal digit requires 4 bits of data.*

BDS bit no.	Data	Description	ARINC bit no.
1	Status	1 = valid data	30&31
2	Sign		29
3		Msb=90 deg.	28
4			27
5			26
6		BEARING TO WAYPOINT	25
7		Label 115	24
8			23
9		Range=[+-180 deg.]	22
10			21
11			20
12		Lsb= 360/2048 degs.	19
13	Status	1 = valid data	30&31
14			29
15		10 min. digit	28
16			27
17			26
18		TIME TO GO	25
19		Label 002 (BCD)	24
20		1 min.	23
21		Range=[0, 99.9 min]	22
22			21
23		0.1 min	20
24			19
25			18
26	Status	1 = valid data	30&31
27			29
28		100 nm. digit	28
29			27
30			26
31		DISTANCE TO GO	25
32		10 nm.	24
33		Label 001 (BCD)	23
34			22
35		Range=[0,999.9 nm]	21
36			20
37		1 nm.	19
38			18
39			17
40		0.1 nm.	16
41			15
42			14
43			
44			
45			
46			
47			
48			
49			
50			
51			
52			
53			
54			
55			
56			



**BDS 4.4 Meteorological Routine Report**

Purpose: To allow meteorological data to be collected by ground systems.

The decimal value of the binary coded ( figure of merit ) FOM/SOURCE parameter must be interpreted as follows:

- 0 = Invalid
- 1 = INS
- 2 = GNSS
- 3 = DME/DME
- 4 = VOR/DME
- 5-15 = Unassigned

Notes:

1) ARINC 429 label 315 only supplies data with an MSB of 128. When using this data source, bit 6 in the MB field is not used and must be set to 0.

2) The interpretation of the two bits assigned to TURBULENCE is as shown in the table for BDS 4,5.

3) The average static pressure is not a requirement of Annex 3.

BDS bit no.	Data	Description	ARINC bit no.	
1		FOM/SOURCE		
2				
3				
4				
5	Status	Wind parameters		
6		WINDSPEED Label 315 Range = [0,512 kt ] msb = 256 kt lsb = 1 kt	28	
7			27	
8			26	
9			25	
10			24	
11			23	
12			22	
13			21	
14			20	
15	Sign		29	
16		WIND DIRECTION Label 316 Range = [+180 deg] msb = 90 deg. lsb = 180/256 deg	28	
17			27	
18			26	
19			25	
20			24	
21			23	
22			22	
23			21	
24	Status		STATIC AIR TEMPERATURE Label 213 Range = [+128 C ] msb = 64 deg C lsb = 0.25 C	30&31
25	Sign			29
26		26		
27		25		
28		24		
29		23		
30		22		
31		21		
32		20		
33		19		
34		18		
35	Status	AVERAGE STATIC PRESSURE Label 217 Range = [2048 hPa] msb = 1024 hPa lsb = 1 hPa	30&31	
36			28	
37			27	
38			26	
39			25	
40			24	
41			23	
42			22	
43			21	
44			20	
45			19	
46			18	
47	Status	TURBULENCE		
48				
49				
50	Status	HUMIDITY msb = 100% lsb = 100/64%		
51				
52				
53				
54				
55				
56				



**BDS 4.5 Meteorological Hazard Report**

ModeS Specific Service Format

Purpose: To provide reports on the severity of meteorological hazards, in particular for low flight.

The interpretation of the two bits assigned to each hazard is defined in the table below:

Bit 1	Bit 2	
0	0	Nil
0	1	Light
1	0	Moderate
1	1	Severe

*Note : The definition of the terms Light, Moderate, and Severe are those defined in the PANS-RAC ( Doc.4444) where applicable.*

BDS bit no.	Data	Description	ARINC bit no.
1	Status	1 = valid data	
2		TURBULENCE	
3			
4	Status		
5		WIND SHEAR	
6			
7	Status		
8		MICROBURST	
9			
10	Status		
11		ICING	
12			
13	Status		
14		WAKE VORTEX	
15			
16	Status		
17	Sign	Msb = 64 deg c  STATIC AIR TEMPERATURE Label 213 Range = [ +- 128 deg C]  Lsb = 0.25 deg C	29
18			28
19			27
20			26
21			25
22			24
23			23
24			22
25			21
26			20
27	Status		30&31
28		Msb = 1024 hPa  AVERAGE STATIC PRESSURE Label 217  Range = 0, 2048 hPa  Lsb = 1 hPa	28
29			27
30			26
31			25
32			24
33			23
34			22
35			21
36			20
37			19
38		18	
39	Status		30&31
40		Msb = 32 768 ft  RADIO HEIGHT Label 164  Range = 0, 65 528 ft  Lsb = 16 ft	28
41			27
42			26
43			25
44			24
45			23
46			22
47			21
48			20
49			19
50			18
51		17	
52			
53			
54			
55			
56			



**BDS 5.0 Track and turn report**

Mode S Specific Services Format

1. All references to ARINC assume that the ARINC 429 standard is used.
2. The BDS servicing process will make a logical AND of bits 30 & 31 of each ARINC parameter and insert the result into the status bit for the corresponding parameter.
3. The maximum acceptable data age at time of transmission to the ground is 1 s for all parameters.
4. The BDS update rate will be sufficient to ensure that the maximum acceptable data age of all parameters is not exceeded in normal operation.
5. If maximum acceptable data age is exceeded for any parameter, then the status bit for that parameter should actively be set to 0 by the BDS processing service.
6. If the value of a parameter from the data source exceeds the range allowable in the BDS definition, the maximum allowable value in the correct positive or negative sense will be used instead.

Notes:

*1) The data entered into this register should, whenever possible, be derived from the sources that are controlling the aircraft.*

*2) This requires active intervention by the BDS servicing process.*

*3) Where ARINC 429 is used, this only relates to parameters where the most significant bit or bits have been omitted from the BDS format.*

7. If any parameter is not available on the aircraft, all bits corresponding to that parameter must be actively set to 0 by the BDS servicing process.

*Note : If any parameter becomes unavailable due to abnormal operation, then item 5 above applies.*

BDS bit no.	Data bit no.	Description	ARINC bit no.	
1	Status	1 = valid data	30&31	
2	Sign	1 = left (left wing down )	29	
3		ROLL ANGLE Label 325  Range =[ + - 90deg ]	27	
4			26	
5			25	
6			24	
7			23	
8			22	
9			21	
10			20	
11			19	
12	Status		1 = valid data	30&31
13	Sign		1 = west ( e.g. 315 = -45 deg)	29
14		TRUE TRACK ANGLE Label 313  Range =[ + - 180 deg ]	28	
15			27	
16			26	
17			25	
18			24	
19			23	
20			22	
21			21	
22			20	
23			19	
24	Status		1 = valid data	30&31
25		GROUND SPEED Label 312  Range = [0,2046 ]	27	
26			26	
27			25	
28			24	
29			23	
30			22	
31			21	
32			20	
33			19	
34			18	
35			1 = valid data	30&31
36		1 = minus	29	
37		TRACK ANGLE RATE Label 335  Range = [-16,+16]	27	
38			26	
39			25	
40			24	
41			23	
42			22	
43			21	
44			20	
45			19	
46			1 = valid data	30&31
47			TRUE AIR SPEED Label 210  Range =[0,2046]	28
48		27		
49		26		
50		25		
51		24		
52		23		
53		22		
54		21		
55		20		
56		19		



**BDS 5, 1 Position Report Coarse**

ModeS Specific Service Format

**PURPOSE:** To provide a three-dimensional report on aircraft position.

Notes :

1) The single status bit ( bit 1 ) is to be set to 0 if any of the three parameters are invalid and are identical to the status bit in BDS 5,2.

2) The required valid range for latitude is +90 degrees to - 90 degrees, but the parameter is coded with an msb of 90 degrees to allow the use of the same coding algorithm as for longitude.

3) The source of the information in this buffer is the same as that indicated in the FOM/SOURCE field of BDS 5,2.

BDS bit no.	Data	Description	ARINC bit no.	
1	Status	1 = valid data		
2	Sign			
3		msb = 90 deg  LATITUDE Range =[ +180 deg ]		
4				
5				
6				
7				
8				
9				
10				
11				
12				
13				
14				
15				
16				
17				
18				
19				
20				
21			lsb = 360/1048576 deg	
22	Sign	msb = 90 deg  LONGITUDE Range =[ +-180 deg ]		
23				
24				
25				
26				
27				
28				
29				
30				
31				
32				
33				
34				
35				
36				
37				
38				
39				
40				
41			lsb = 360/1048576 deg	
42	Sign	msb = 65536 ft  PRESSURE ALTITUDE  Range = 131068 ft		
43				
44				
45				
46				
47				
48				
49				
50				
51				
52				
53				
54				
55				
56			lsb = 8 ft	



**BDS 5, 2 Position Report Fine**

ModeS Specific Service Format

**PURPOSE:** To provide a high precision three-dimensional report on aircraft position, when used in conjunction with BDS 5,1. Information on the source of data is included.

The decimal value of the binary coded ( figure of merit ) FOM/SOURCE parameter is to be interpreted as follows:

- 0 = Loss of navigational capability.
- 1 = RNP 20 (e.g. INS data) pressure altitude.
- 2 = RNP 5 (e.g. VOR/DME) pressure altitude
- 3 = RNP 1 (e.g DME/DME or GNSS) pressure altitude
- 4 = Reserved for differential GNSS ( circular position error (CPE) 10m) pressure altitude.
- 5 = Reserved for differential GNSS (CPE 2.5 m) pressure altitude.
- 6 - 10 = Unassigned
- 11 = RNP 1 ( e.g. DME/DME or GNSS) GNSS height
- 12 = Reserved for differential GNSS (CPE 10 m) height.
- 13 = Reserved for differential DGNSS (CPE 2.5 m) height
- 14-15 = Unassigned.

where RNP is required navigational performance as defined by ICAO. Suitable RNP categories have not yet been defined for values below 1; therefore CPE is used.

The single status bit (bit 1) is to be set to 0 if any of the three parameters are invalid and are identical to the status bit in BDS 5,1.

Notes :

1) The *LATITUDE (fine)* and *LONGITUDE (fine)* parameters are in 2's complement coding, so they must be interpreted in conjunction with the corresponding parameters BDS 5,1.

2) When GNSS height is contained in the altitude field, the pressure altitude can be obtained from BDS 5,1.

BDS bit no.	Data bit no.	Description	ARINC bit no.
1	Status	1 = valid data	
2		FOM/SOURCE	
3			
4			
5			
6			LATITUDE FINE Range = 180/128 deg
7			
8			
9			
10			
11			
12			
13			
14			
15			
16			
17			
18			
19			
20			
21			
22			
23		lsb = 90/16777216 deg	
24		LONGITUDE FINE Range = 180/128 deg	
25			
26			
27			
28			
29			
30			
31			
32			
33			
34			
35			
36			
37			
38			
39			
40			
41		lsb = 90/16777216 deg	
42	Sign	PRESSURE ALTITUDE Range = 131068 ft	
43			
44			
45			
46			
47			
48			
49			
50			
51			
52			
53			
54			
55			
56		lsb = 8 ft	





**BDS 5.3 Air-referenced State Vector**

ModeS Specific Service Format

**PURPOSE:** To provide the ATC system with the current measured values of magnetic heading, IAS/Mach, altitude rate and TAS.

BDS bit no.	Data bit no.	Description	ARINC bit no.
1	Status	1 = valid data	30&31
2	Sign		29
3		msb = 90 deg	28
4			27
5		MAGNETIC HEADING	26
6		Label 320	25
7			24
8		Range =[ +-180 deg ]	23
9			22
10			21
11			20
12		lsb = 360/2048 deg	19
13	Status	1 = valid data	30&31
14		msb = 512 kt	28
15			27
16			26
17		INDICATED AIRSPEED (IAS)	25
18		Label 206	24
19			23
20		Range = 0, 1024 kt	22
21			21
22			20
23		lsb = 1 kt	19
24	Status	1 = valid data	30&31
25		msb = 2.048	28
26			27
27			26
28		MACH NUMBER	25
29		Label 205	24
30			23
31		Range = 0, 4.096	22
32			21
33		lsb = 0.008	20
34	Status	1 = valid data	30&31
35		msb = 1024 kt	28
36			27
37			26
38			25
39		TRUE AIRSPEED (TAS)	24
40			23
41		Range = 0,2048 kt	22
42			21
43			20
44			19
45			18
46		lsb = 0.5 kt	17
47	Status	1 = valid data	30&31
48	Sign		29
49		msb = 8192 ft/min	28
50			27
51		ALTITUDE RATE	26
52		Label 212	25
53			24
54		Range = +- 16384 ft/min	23
55			22
56		msb = 64 ft/min	21



**BDS 6.0 Heading and speed report**

ModeS Specific Service Format

1. All references to ARINC assume that the ARINC 429 standard is used.

2. The BDS servicing process will make a logical AND of bits 30 & 31 of each ARINC parameter and insert the result into the status bit for the corresponding parameter.

3. The maximum acceptable data age at time of transmission to the ground is 1 s for all parameters.

4. The BDS update rate will be sufficient to ensure that the maximum acceptable data age of all parameters is not exceeded in normal operation.

5. If maximum acceptable data age is exceeded for any parameter, then the status bit for that parameter should actively be set to 0 by the BDS processing service.

6. If the value of a parameter from the data source exceeds the range allowable in the BDS definition, the maximum allowable value in the correct positive or negative sense will be used instead.

Notes:

1) *The data entered into this register should, whenever possible, be derived from the sources that are controlling the aircraft.*

2) *This requires active intervention by the BDS servicing process.*

3) *Where ARINC 429 is used, this only relates to parameters where the most significant bit or bits have been omitted from the BDS format.*

7. All parameters are required except for *Inertial Vertical Velocity* which will be supplied only by aircraft with a suitable inertial source. If *Inertial Vertical Velocity* is not available bits 46 to 56 inclusive must be actively set to 0 by the BDS servicing process.

BDS bit no.	Data bit no.	Description	ARINC bit no.
1	Status	1 = valid data	30&31
2	Sign	1 = west	29
3		msb = 90 deg	28
4			27
5		MAGNETIC HEADING	26
6		Label 320	25
7			24
8		Range =[ +180 deg ]	23
9			22
10			21
11			20
12		lsb = 90/512 deg	19
13	Status	1 = valid data	30&31
14		msb = 512 kt	28
15			27
16			26
17		INDICATED AIRSPEED	25
18		Label 206	24
19			23
20		Range = [0, 1023]	22
21			21
22			20
23		lsb = 1kt	19
24	Status	1 = valid data	30&31
25		msb = 2.048 mach	28
26			27
27			26
28		MACH NUMBER	25
29		Label 205	24
30			23
31		Range = [0, 4.096 ]	22
32			21
33			20
34		lsb = 2.048/512	19
35	Status	1 = valid data	30&31
36	Sign	1 = below	29
37		msb = 8192 ft/min	27
38			26
39		BAROMETRIC ALTITUDE	25
40		RATE	24
41		Label 212	23
42			22
43		Range = [-16384, +16352 ]	21
44			20
45		lsb = 32 ft/min	19
46	Status	1 = valid data	30&31
47	Sign	1 = below	29
48		msb = 8192 ft/min	27
49			26
50		INERTIAL VERTICAL	25
51		VELOCITY	24
52		Label 365	23
53			22
54		Range = [-16384, +16352 ]	21
55			20
56		lsb = 32 ft/min	19